

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



United States Department of Agriculture

Forest Service

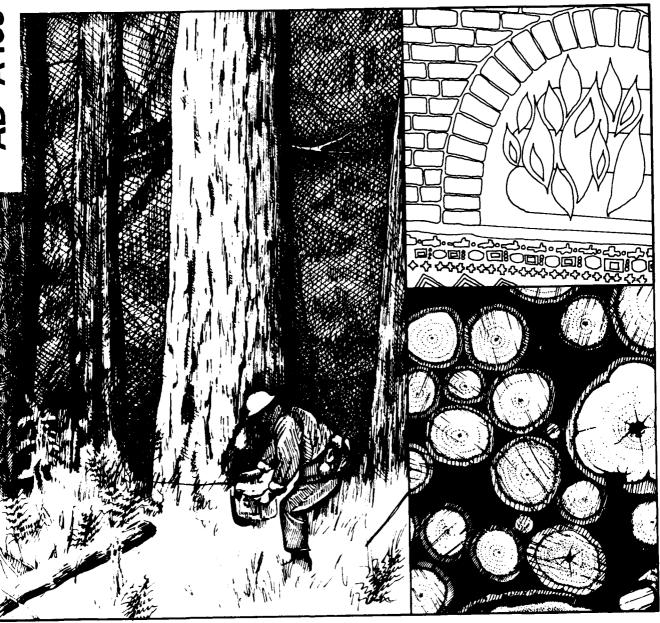
Forest Products Laboratory

General Technical Report FPL-46

A Computer Program for Analysis of **Fuelwood Harvesting Costs**

AD-A159

George B. Harpole Giuseppe Rensi



DISTRIBUTION STATEMENT A Approved for public release Distribution Unlimited

Abstract

The fuelwood harvesting computer program (FHP) is written in FORTRAN 60 and designed to select a collection of harvest units and systems from among alternatives to satisfy specified energy requirements at a lowest cost per million Btu's as recovered in a boiler, or thousand pounds of H₂O evaporative capacity kiln drying. Computed energy costs are used as a criterion of economic viability. Sensitivities of energy costs and fuel requirements to changes in moisture content are computed and provided in the printed output.

Keywords: Wood/bark fuel, harvesting, economics, computer program.

•

October 1985

Harpole, George B.; Rensi, Giuseppe. A computer program for analysis of fuelwood harvesting costs. Gen. Tech. Rep. FPL-48. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory; 1985. 18 p.

Animited number of tree copies of his publication are available to the public from the Forest Products Laboratory. One difford tinchot Drive, Madison, WI 53705 Laboratory publications are sent to over 1,000 libraries in the United States and elsewhere.

The Laboratory is maintained in cooperation with the University of Wisconsin.

A Computer Program for Analysis of **Fuelwood Harvesting Costs**

George B. Harpoie, Research Forester

Forest Products Laboratory, Madison, WI

Giuseppe Rensi, Professor

Department of Economics and Marketing, California State University, at Hayward Hayward, CA

Introduction

Forest residues represent an abundant wood source often unutilized because of the inability of market prices to support costs for harvesting. In some circumstances, however, harvesting forest residues for fuel may be combined with harvesting of wood-chip and cull-log products to offer economic and environmentally desirable utilization of forest residues. The fuel harvest analysis computer program (FHP) is designed to select harvest units and harvest systems from a number of alternatives to satisfy specific energy requirements, at a lowest cost per million Btu's as recovered in a boiler (as exemplified in fig. 1), or per thousand pounds of H2O evaporative capacity for kiln drying (as exemplified in fig. 2). The energy costs so computed can then be used as a criterion for economic viability of various harvesting options.

The FHP computer program given in the appendix is written in FORTRAN 60 for use by forestry planners, business analysts, and utilization economists. The program is designed for application to logging operations where the following conditions apply:

- · year-round headquarters are maintained for business management and equipment storage and repair,
- harvesting opportunities are available at different harvest sites and wood supplies may collectively exceed fuel product demand and harvesting capacities,
- prospective harvest units may have different cost requirements for construction of roads and landings,
- alternative harvesting systems may be employed at any harvest unit for production of different product mixes of fuel and other marketable products.

Structure of the FHP computer program follows standard accounting practices. Computed energy costs are residual costs, i.e. the net amount of costs and revenues from marketable products are a residual cost which may be negative in situations where revenues exceed all costs. Costs for risk and/or requirements for profit on working capital may be included. Marginal cost analyses may be accomplished by representing a harvest unit as a series of different intensities of possible harvesting. For all analyses, sensitivities of energy costs and fuel requirements to changes in moisture content are computed and provided in the printed output (figs. 1 and 2).

		sion For	
	NTIS DTIC	GRA&I TAB	
	Union	iounded .Theution	<u> </u>
	By	ibution/	
ŀ		lability	Ordes
OTIC	Dist	Avail and Spoola	•
Core	A-1		



Data Input Requirements

To select

■ でんちょう かんきゅう ちょうかん かんしゅ ■ アンファン・ファン・サンシン しょうじんじん 自然ないないない

Use of the FHP computer program requires good estimates of costs per hour for each operable harvesting system considered, and good estimates of the number of operating hours required per acre of harvest area. The entries for generation of the problem specification and printed output of figures 1 and 2 are derived from data coding worksheets (figs. 3 and 4). Input requirements for these worksheets are described below:

Card Type 1: Title card (fig. 3) for captioning printed output (first card in data deck).

Card Type 2: Program constants (fig. 3) (second card in data deck).

Cols. 2-3: Number of Harvest Units. Enter number of harvest units to be considered, up to 50 harvest units.

Cols. 7-10: Stack Temperature. Enter in degrees Fahrenheit (at least 100°), for computation of costs per million Btu's of steam. A stack temperature of 375°F is typical. If no entry is made, the program computes costs per thousand pounds of H₂O evaporative capacity of stack gases (1,700 Btu's per pound of water evaporated as in a dry kiln). Boiler efficiency calculations assume 40 percent excess air and 4 percent heat loss from unburned fuel, radiation, and unaccounted heat losses.¹ The equations used for computation of boiler efficiencies are shown in table 1.

Table 1.—Equations used for computation of boiler efficiencies

moi coi	ge of sture ntent basis)	Boiler efficiency (BE) versus Moisture content fraction, wet basis (MCW) and Stack temperature in fahrenheit (°F) (ST)
From	To	
0	0.285	BE = 0.9350 ~ (MCW * 0.18182) ~ (ST * 0.000310)
0.286	0.443	BE = 1.0019 - (MCW * 0.35454) - (ST * 0.000345)
0.444	0.545	BE = 1.0920 - (MCW * 0.51232) - (ST * 0.000385)
0.545 0.615	0.614 greater	BE = 1.3128 - (MCW * 0.87770) - (ST * 0.000410) BE = 1.4646 - (MCW * 1.09615) - (ST * 0.000445)

Cols. 11-20: Annual Heating Requirements. Enter in millions of Btu's if stack temperature is specified, otherwise in number of pounds (in thousands) of H_2O to be evaporated annually.

Cols. 23-30: Fixed Cost. Enter the annual costs for headquarter operations, i.e. for business management, equipment storage and repair, etc.

Cols. 34-35: Number of Weeks for Working Capital. Enter average time in weeks, from actual payout for wages, supplies, etc., until cash returns are realized from sale of products and/or to time fuel is burned.

Cols. 41-45: Risk-Profit Requirement. Enter a decimal fraction amount to indicate desired or alternative rate-of-return for investments.

Card Type 3: Harvest unit data card (fig. 3). One card must be prepared for each harvest unit to be considered. Harvest system data cards (card type 4) and harvest system's product data cards (card type 5) will be assembled in filling fashion following each corresponding harvest unit card (card type 3).

Col. 1: Enter "U" to identify Card as a harvest unit data card

Cols. 2-3: *Harvest Unit Number*. Enter the sequential number of the harvest unit.

Cols. 5-10: Harvest Unit Name. Enter any alphanumeric captioning for the harvest unit.

Cols. 15-20: *Unit's Unit Measure*. Enter unit of measure used for harvest area's wood/bark materials, such as "cubic feet," "MBF," "Scribner," etc.

Cols. 24-30: Harvest Unit's Acres. Enter the total number of acres to be harvested in the harvest unit.

Cols. 34-40: Units per Acre. These units must correspond to the unit of measure entered in Cols. 15-20.

Cols. 44-50: *Unit's Fixed Cost*. Enter the estimated fixed cost for putting the harvest unit into condition suitable for harvesting operations. This amount should include costs for landings, roads, lump sum amounts for stumpage, and the like.

Cols. 54-55: *Number of Systems*: Alternative harvesting systems may be considered for each harvest unit, each with different operating costs per hour and product mix. Data for each system will follow. The number of alternative systems to be considered must be entered here.

Cols. 59-64: Cubic Feet per Unit. Enter the number of cubic feet of solid wood/bark per unit of measure used. If cubic feet is the unit of measure then 1.0 must be entered. If MBF (thousand board feet) is entered, then an appropriate figure somewhere between 160.0 and 225.0 should probably be entered—representing the number of cubic feet of solid wood per MBF.

Card Type 4: Harvest system data (fig. 4). Prepare one harvest system data card for each system considered for a harvest unit.

Col. 1: Enter "S" to identify the card as a system card.

Cols. 2-3: System's Number. Enter the sequential number for each system alternative.

Cols. 5-10: System's Name. Enter any alpha-numeric captioning desired for the system.

¹Corder, S. F. Wood and bank as fuel, School of Forestry Research Bulletin 14. Corvalius, OR: Oregon State University; 1973.

Cols. 14-15: *Number of Products*. Enter the number of different kinds of product expected to be produced by the system.

Cols. 16-20: Hours per Acre. Enter the average number of operating hours required to harvest an acre of the harvest unit.

Cols. 24-30: System's Variable Cost. Enter the cost per hour of operating the system.

Cols. 31-50: Fuel Description. Enter any alpha-numeric caption to describe the fuel type, e.g. chips, cordwood, etc.

Cols. 61-65: *Moisture Content*. Enter in decimal fraction the moisture content of fuel, wet basis, as fired.

Cols. 66-70: Specific Gravity. Enter in decimal fraction the specific gravity of the fuel product.

Cols. 71-75: Higher Heating Value. Enter the higher heating value in thousands of Btu's per ovendry pound of wood bark fuel type.

Card Type 5: Harvest system's product data (fig. 4). Use one card for each product. Up to 10 products, including fuel, may be considered.

Col. 1: Enter "F" for identification of the first card in the product list, which must have data for the fuel to be harvested.

Cols. 2-3: Fuel Product Number. Enter the sequential number for each product.

Cols. 5-10: Fuel Name. Enter any alpha-numeric designation for captioning printed output.

Cols. 15-20: Fuel, Product Percentages. Enter the percent of solid wood bark expected to be realized from total harvest by each product. Percentages for all products, including fuel, must add to 100.0 percent.

Cols. 25-30: *Product's Unit*. Enter any alpha-numeric code for printed output captioning.

Cols. 34-40: Cubic Feet of Product, per Unit. Enter the number of cubic feet of solid wood/bark per nominal unit given to each product.

Cols. 44-50: Variable Cost. Enter cost in dollars per unit, associated directly with production (stumpage, chipping, etc.) and delivery of the product type to point where no further product-associated costs will accrue.

Cols. 54-60: Market Value. Enter realization per unit (selling price less all discounts, allowances, etc.) anticipated from the product type, if product is intended for sale. No value should be entered if the product is the fuel for which a cost is to be computed.

510
1LL 10N
I
PER
COST
FUEL
2 1 NG
21m1n1H
FOR
ALAL YSIS
HARVEST

PROBLEM SPECIFICATIONS	
NUMBER OF MAHVEST UNITS STACK GAS TEMPEHATUHE (DFGREES F) 350. ANNIAL HEAT REQUIREMENT (MMBTU) 1160000. (IVEMMEAL FIXED COSTS (DULLARS) 80000. MORKING CAPITAL REQUIREMENT (MEEKS) 8	
MOTE: IF STACK GAS TEMPERATURE ENTEPED IS LESS THAN 100, DEGREES F., COSTS PER THOUSAND POUNDS OF M20 EVAPORATIVE CAPACITY MILL HE CALCULATED AS FOR DIRECT-FIRED MILM USE, ANNUAL HEAT REGUINEMENTS MUST BE ENTERED AS NUMBER OF THOUSAND POUNDS OF M20 TO BE REMOVED FROM LUMBER THROUGH MILM.	
HARVEST UNIT JUNIPR 1 ACRES SOOG.O TOTAL CU. FT. AVAIL SOOG.OM INPUT SEJUENCE NO. 1 VOL./ACRE IN CU FT 1000.O CU. FT., SOLID/UNIT 1.0 NO. MARVEST SYSTEMS 1 MARVEST UNIT FIXED COSTS 5000.	
SYSTEM HRS/ COST/ PROD PERCENT UNIT SOLID UNITS PREP MKT MOIS MMBTU COST/ MBTU/ V ACRE HOUR CODE TUTAL NAME CU.FT./ AVAILABLE COST/ VAL/ CONT AVAILABLE UNIT UNIT C	COST.
JUNIPH 1 3.50 200. FUEL 100.00 FUNIT 72.00 69444. 7.50 .00 .26 912089. 57.90 13134.08	08 4.41
*** LEAST COST HARVEST SYSTEM JUNIPR 1 *** HARVEST UNIT JUNIPR 1	
-FUELENERGY-	
UNITS AVAIL 69444, MMBT1 4VAIL 912089, FIXED COST 5000, COST/MMBTU 4,41	
.JIEM IS THOUSANDS, MM IS MILLIOMS. 'ITOTAL COST/UNIT'' INCLUDES HARVEST UNIT FIXED COST, BUT DUES NOT INCLUDE ''OVERHEAD FIXED CUST'', OR CUST (IN FOR WOMKING CAPITAL REGULMENT.	(INTEREST

Figure 1.—Example of harvesting cost analysis per million Btu s.

	VAR. COST/ MMbtu	3 0 1	2.38				(INTEREST)				EAM S/MMBTU	4.52	
	MBTU/ UNIT	12592.86 -4.64	12592.86						d		RGY VALUES==== HEAT TO STEAM HBTU/UNIT S/HM	12592.86 \$	
	C0S1/ UNIT	-56.47	30.00				COST		***		-ENERGY	125	
160.00M	MMHTU AVAILABLE	279841.	1119365.				DUES NOT INCLUDE **OVERHEAD FIXED COST**, OR COST		STACK TEMP.) ************************************		HIGHER VALUE HBTU/UNIT	16179.	
11	HO18	~	62.				^				-	94	
SOLIOZUNIT	MKT VAL/ UN17	.00 200.00 145.00	00.				INCLUDI	10N 8TU	(350. DEG.F	18 ass	S COST	\$ ~56.89 \$ 57.97	
101AL CU. CU. CU.	PHEP COST/ Unit	7.50	7.50				VES NOT	PER MILLION		AND COS	M.C.	.2900	
2000.0 10 20.0 CU 3500U.	UNITS AVAILABLE	2222. 6000. 8000. 25600.	. 6888	*		279841. -4.52	801	COST	REQUIREMENTS AND COSTS	MEAT ENERGY SOURCES AND COSTS	SPEC. GRAV.	007.	
COSTS	SOLID CU.FT./ UNIT	72.00 160.00 160.00	72.00	0LD GR 1	• X:		UNIT FIXED COST,	HINIMIZING FUEL	O.F.	HEAT ENE	cu.FT. SOLID	72.00	
HBF FIXED	UNIT	FUNIT 188 188 80U	FUNIT	7 E H 0 GR	-ENERGY	BTU AVAIL IST/MMBTU	F 8 -	FOR HI	IMATES		, , ,		
ACPE IN ST UNIT	PERCENT TOTAL Recov	25.00 15.00 20.00 40.00	100.00	SYS		22222. MM 35000. CU	ILLIONS. ILUDES HARVE REGUIREMENT	A:14L V 3 I S	EST		UNITS AVA	2222	MILL IONS.
ACRES VOL.	PHOD	FUEL LOGS 1 LOGS 2 PCHIPS	FUEL	COST HARVEST Harvest unit		35	DUSANDS, MW IS WI COST/UNIT++ INCL MORKING CAPITAL F	HARVEST	NO I LAWNS		UNIT	FUNIT	
~ ~	COST/ HOUR	250.	200.	*** LEAST	Ŀ	AVAIL CUST COST/UNIT	NOS. ING C	•	PE & S.			¥	*08°
IT UNIT OLD GR SEQUENCE NO.	HRS/ C	05.5	5.00	*	•FUEL	UNITS A FINED C TOTAL C	IS THOUSA FOTAL COS FOR HORK		FUEL TY			SOURCE(S) CHIPS-MINED CHIPS-JUNIPER	15 THOUSA
HARVEST UNIT DLD GR INPUT SEGUENCE NO. NO. HARVEST SYSTEMS	SYSTEN	00 GR 1	0L0 6R 2				MOTEM IS THOUSANDS, MW IS MILLIONS. 		ONP SNOIL TYPE ASSUMPTIONS AND			PAOPOSED S 1) FVEL C 2) FVEL C	NOTE IS THOUSANDS, MM IS

Figure 1 -- Example of harvesting cost analysis per million Btu's.—con.

MARVEST ANALYSIS FOR MINIMIZING FUEL COST PER MILLION BTU

•	PROSPEC	**** PROSPECTUS REGUIREMENT	_	1160000.	HILL 10N	STEAM-HEAT	S (1160000, MILLION STEAM-HEAT BTU S/YEAR) AND AVEHAGE COST/MHBTU ****	PRAGE COST	/MHBTU AREA	
				ANNUAL	VOLUMES	REQUIRED AT	ANNUAL VOLUMES REQUIRED AT VARIOUS MOISTURE CONTENTS (MET BASIS)	CONTENTS (WET BASIS)	•
PROPOSED SOURCES	30	UNIT BASIS	AT GIVEN M.C.		AT HIGHE PCT.	AT HIGHER MOISTURE CONTENTA- +5 PCT. +10 PCT. +20 PCT.	CONTENT# +20 PCT.	AT LOWER -S PCT.	AT LOWER HOISTURE CONTENTAR PCT10 PCT20 PCT	CONTENTAR -20 PCT.
1) FUEL CHIPS-PIXED 2) FUEL CHIPS-JUNIPER	JUNIPER	FUNIT	22222.2	22.5	22222.2	22222.2	69444.4	22222.2	22222.2	22222.2 64635.1
AVG. C051/MM81U			\$ 2.52	•	2.58	\$ 2.64	\$ 2.78	\$ 2.47	\$ 2.42	\$ 2,32
EST.D TOTAL CUSTS	STS		\$2972.7H	š			***************************************	\$2916.9H	\$2854.92	\$2735.34
MORKING CAPITAL PEG	PEG		8 919.4m	4	S 933.1M	8 433.1H	8 933.1X	\$ 905.8H	HC.048	\$ 862.9H
* MOND FUEL CALCULATIONS ASSUME 40-PCT EXCESS AIR AND 4-PCT MEAT LOSS FROM UNBURNED FUEL, MADIATION AND UNACCOUNTED LOSSES. THE PROGRAM ALLOWS MODO FUEL MOISTUME CONTENT CONTENTS TO DWOP BELOW 0-PCT AUT DISTUALIFIES A FUEL TYPE WHEN MOISTURE CUNTENT EXCEEDS 65-PCT.	ULATIONS ANG UNAC BELOM O	ASSUME 4 COUNTED L -PCT BUT	OSSES. THE DISGUALIFIE	IS AIR AND PROGRAM ASS A FUEL T	E-PCT TE TLONS NO YPE NIEN	AT LOSS FRO OO FUEL HOI HOISTURE C	H UNBURNED Stupe Untent			

7895,2 MMBTU'S 1 35115,6 MMBTU'S 1 89562,2 MMBTU'S 1 90 OEFICIT OEFICIT OEFICIT ANNUAL NOTE---M IS THOUSANDS, MM IS MILLIONS. ---CUSIS INCLUDE ''OVERMEAD COST'' AND WORKING CAPITAL COST(INTEREST). Z Z Z 2 I S 10 PCT. (AET BASIS), THERE 20 PCT. (MET BASIS), THERE =5 PCT. (MET BASIS), THERE MITH MOISTUNE CONTENT CHANGED MITH MOISTUNE CONTENT CHANGED MITH MOISTUNE CUNTENT CHANGED ::

* * * *

Figure 1.—Example of harvesting cost analysis per million Btu's.—con.

SPECIFICAL MERCECAL TERRESONAL PROFESSION SECTIONS

H20
EVAP.
0 F
LBS.
THOUSAND
PER
COST
FUEL
DNI21HINIH
FOR
ANAL YSIS
HARVEST

				VAR. COST/ MEH20	6.93				TEREST)
				MBTU/ UNIT	8359.62				2 COST (IV
		0.0		CDST/ UNIT	57.90				io
		POUNDS OF H20 REGUIREMENTS OUGH #ILN.	5000.0H	MMBTU Available	580529.				ST UNIT FIXED COST, פּױַד DOES NOT INCLUDE ייַםער פּאָרנּאַם בּוַאנּט מָטַצוּיי, ייַא מַטַּצוּ (וייַדּאָבּאַד) •
		DUSAND P L HEAT A ER THRO.		MOIS CONT AV	5. 85.				OVE.
		PER TH	TOTAL CU. FT. AVAIL CU. FT., SOLID/UNII	MKT VAL/ UNIT	.00				INCLUDE
		MILN USE	TAL CU.	PREP COST/ UNIT	7.50				0ES NOT
		DEGREES F ECT=FIRED 3 TO BE RE	5000.0 Tn 1000.0 CU 5000.	UNITS AVAILABLE	. 4444	•		58052°. 6.93	0ST, 811 D
	690000. 690000. 600000.	IF STACK GAS TEMPERATURE ENTERED IS LESS THAN 100, DEGREES F., COSTS PER THOUSAND POUNDS OF EVAPORATIVE CAPACITY MILL BE CALCULATED AS FOR DIRECT—FIRED KILN USE, ANNUAL HEAT REGUIREMENALS BE ENTERED AS NUMBER OF THUISAND POUNDS OF M20 TO BE REMOVED FROM LUMBER THROUGH MILN.		SOL IO CU.FI./ UNIT	72.00	JUNIPR 1 .	Ł		IT FIXED C
	(DEGREES F) (MRH20; (DOLLAR') (NEE'S)	13 LESS	CIJ FT Flxed custs	UNT	FUNIT	SYSTEM JULITAN	-ENERGY-	HMBIU AVAIL Cost/mmbiu	VEST UN
	0	ENTERED BE CALC	ACPES Vol. Jacre In Marvest unit	PERCENT TOTAL RECUV	100.00 F	en .		69444. H 5000. C 57.97	S THOUSANDS, HU IS GILLICAS. OTAL COST/UNIT** INCLUBES HARVE FUR WORKING CAPITAL REGUIREMENT
	NUMBER OF HARVEST UNITS STACK GAS TEMPERATURE A-WOAL MEAT REQUIREMENT OVERHEAD FIKEU COSTS MORAING CAPITAL REDUIREMENT RISH-PROFITPERCENT REGOT	HATURE ITY AILL	ACRES VOI / V	PROD CODE	200. FUEL	COST MARVEST MARVEST UNIT		•	MN IS AL T'' INCL APITAL 9
SNOII	ARVEST LE REGULRE LA REGULRE PERCENT	E CAPACI TERED AC	. ря С Г. 48	C081/ H00R		*** LEAST	-FUEL-	UMITS AVAIL Fixed cost Total cost/unit	SANDS, OST/UNI RAING C
PEC IF IC	NUMBER OF MARVEST UNITS STACK GAS TEMPERATURE A-NUAL MEAT REDUREWENT OVERMEAU FIKEU COSTS MORKING CAPITAL REDUREM RISK-PROFITPERCENT REGUT	914CF G 9044TIV 51 8F EN	JNIT JUN BUENCE N SI SYST	HRS/ ACRE	3.50	:	•	UNITS FIXED TOTAL	IS THOU • TOTAL C FUR WO
PROBLEM SPECIFICATIONS	2	NUTE: IF STACK GAS TEMPEHATURE ENTERED IS Evaporafive Capacity Aill be Calcol Must be entered as number of thuisa	MARVEST UNIT JUNIPR Input Sequence NU. NO. Marvest systems	SYSTEA	JUNIPR 1				NOTEM IS THOUSANDS, MU IS MILLICYS. **TOTAL COST/UNIT** INCLUBES HARVE FUR WORKING CAPITAL REGUIREMENT
					· · · · · · · · · · · · · · · · · · ·				

Figure 2.—Example of harvesting cost analysis per thousand pounds of water evaporative capacity.

######################################											_			
## COST & CREES **CORE 2*** **CORE 40.**		20	:	0				REST)				RATION /mrh20	-7.21 6.93	
## COST & CREES ***COST*********************************		4 A B C C S M B I	-	m				. ₹ × 1				14	• •	
1010 GB 2 VOL. JACRE IN MUE 2000 10114 CU. FT. AVAIL 6000.00 10114 100.00 2 VOL. JACRE IN MUE 2000 CU. FT., SOLID/UNIT 100.00 2 VOL. JACRE HOUR COST WILL FILED CUSTS 35000 COST WILL FOR AVAILABLE UNIT WILL SECOND WILL SAGE HOUR COST WILL SAGE WORD SAGE WAS SAGE WORD SAGE WAS SAGE WORD) -	87.08	87,08				057 (1				LUES IVE EV	60.0	
CLOSE ACRES New 2000-0 TOTAL CU. FT., SCLID/UNIT 100.0		¥ 5	48	7.8				80		•		GY VA FFECT H20/U	7887 8359	
1010 GR 2 ACRES 2000.0 TOTAL CU. FT., AVAIL 100.0 393E43 2 HARVEST UNIT FIRED COSTS 35000. CU. FT., SOLID/UNIT 100.0 393E43 2 HARVEST UNIT FIRED COSTS 35000. CO. FT., SOLID/UNIT 100.0 483 COST, MANY CONT AVAILABLE COST, WAY, COST		C081/ UNIT	58.47	30.00				081				Ä H		
1010 GR 2 ACRES 2000.0 TOTAL CU. FT., AVAIL 100.0 393E43 2 HARVEST UNIT FIRED COSTS 35000. CU. FT., SOLID/UNIT 100.0 393E43 2 HARVEST UNIT FIRED COSTS 35000. CO. FT., SOLID/UNIT 100.0 4000 COST / WAV/ CONT AVAILABLE COST / WAV/	ı	Ä	•					IXED C	a	•		R VALU	6179.	
STATE STAT	00	161U	569	074				<u>د</u> 0				646 110		
CONTRIGES CONTROL CO	91	A > A	175	701				/ERHEA	EVAP.	COSTS		ï		
STORES S	A 11.	HO15		.29					0F	QN		1081 UNIT	56.89	
100.0 GR 2 VCL.ACRE IN MUF 37.31E 40. 37.31E 40. 37.31E 40. 37.31E 40. 37.31E 40. 48.5. COSI' PROD PERCENT UNIT SOLID UNITS ACRE HOUR CODE TOTAL NAME CU.FT. AVAILAB 5.50 250. FUEL 25.00 FUNIT 72.00 6000. 105.00 200. FUEL 25.00 FUNIT 72.00 6000. 5.00 200. FUEL 100.00 FUNIT 72.00 6000. 6000.	F1. AV 10L10/U	MKT VAL/ UNIT	200.00 145.00	00•				INCLUD	AND LBS		:	. d		
100.0 GR 2 VCL.ACRE IN MUF 37.31E 40. 37.31E 40. 37.31E 40. 37.31E 40. 37.31E 40. 48.5. COSI' PROD PERCENT UNIT SOLID UNITS ACRE HOUR CODE TOTAL NAME CU.FT. AVAILAB 5.50 250. FUEL 25.00 FUNIT 72.00 6000. 105.00 200. FUEL 25.00 FUNIT 72.00 6000. 5.00 200. FUEL 100.00 FUNIT 72.00 6000. 6000.	ال دن. ۲۲., S	PREP COST/ UNIT	7.50	7.50				S NOT		UTREME	SOO ON	#.C.	2900	
### 1000 GR 2 ACRES \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	101. CU.	n E							PER	REG	ES A			
### 1000 GR 2 ACRES	00	N 1 13	255 000 000 000	689			21		C03T	s of	OURC	PEC.	400	
5.50 250. FUEL 25.00 FUNIT FIXED COSTS ACRE NOUN CODE TRECNT UNIT SOLUTIONS ACRE HOUR CODE TRECNT UNIT SOLUTIONS 5.50 250. FUEL 25.00 FUNIT 72.0 100.00 FUEL 25.00 HWF 160.00 FUEL 26.00 HWF 160.00 FUEL 26.00 HWF 160.00 FUEL 100.00 FUNIT 72.0 FUEL 26.00 HWF 160.00 FUEL 100.00 FUNIT 72.0 FUEL 26.00 HWF 160.00 FUEL 100.00 FUNIT 72.0 FUEL 35.00 FUNIT 72.0 FUEL 26.00 HWF 160.00 FUEL 100.00 FUNIT 72.0 FUEL 26.00 HWF 160.00 FUEL 100.00 HWF 160.00 FUEL 100.00 HWF 160.00 FUEL 26.00 HWF 160.00 FUEL 35.00 HWF 160.00 FUEL 100.00 FUEL 100.00 HWF 160.00 FUEL 100.00 HWF 160.00 FUEL 100.00 HWF 160.00 FUEL 100.00 FUEL 100.00	2006.		V 4 6 V	60	:		.5269.	C05T,		IMATE				
### COLD GR 2 ACRES ### COLD GR 2 VOL, ACRE IN MUF ### COST VOLO CONTRICT FIXED COST ### COST VOLO COST VAME COST FOR HINIT ### COST COST MARVEST SYSTEM OLD GR 2 -FUEL	F 1	01. 1.	0000	00	-		1.	re o		EST	ENE	101	9.0	
100 GR 2 ACRES 101 FIX HE SYSTEMS 2 HAFVEST UNIT FIX HRS COST PROD PERCENT UN ACRE HOUR CUDE 105.00 HBF LOGS 2 20.70	00878	SOL	160.	12.		• >	4 I L		21417	S AND	HEAT) 0 0		
SYSTEMS 2 MARYEST UNITERS/ COST/ PROD PERCENACRE HOUR CUDE TOTAL RECOVER HOUR CUDE TOTAL ACRE TO A CRE HOUR CUDE TOTAL SOON THE TOTAL SOON THE STAND THE STAND THE TYPE AS THE	f 0	UNIT NAME	10N1T	TIMO	<u> </u>	ENERG	ТС АV 11.2ММВ	_			* *	۸۱۲. د۲	ν ÷	
SYSTEMS 2 ACRES SYSTEMS 2 VOL./A SYSTEMS 2 VOL./A SYSTEMS 2 VOL./A SYSTEMS 2 VOL./A ACRE HOUR CODE S.SO 250. FUEL LOGS 1 LOGS 2 PCHIPS PROP FUEL FUEL FUEL THUUSANDS, MM IS MILL TAL COST/UNIT INCLUD INTS AVAIL 22222 THUUSANDS, MM IS MILL TAL COST/UNIT INCLUD INTER COST/UNIT BASIS JACE(S) LOGS 1 LOGS 2 PCHIPS PARYESI AN AMERICA THUUSANDS, MM IS MILL IPS-JUNIPER FIUNIT FUEL TY AMERICA THOUSANDS, MM IS MILL IPS-JUNIPER FIUNIT		Z -1 >			SYSI	•	ĬÜ	ARVE MEN1	2	53∪₹		SAV	222	
NUMBUEST UNIT OLD GR 2 ACRESION OLD GR 1 SYSTEM HRS/ COST/ PROD COES 1 LOGS 1 LOGS 1 LOGS 1 LOGS 1 LOGS 2 L	ACRE ST UN	PERCE TOTA RECU	25. 15. 20.	100			•	LIONS DES H BUIRE	VALYS			INI		SNO1
NUTEH IS THOUSANDS, HH IS NUTEH IS THOUSANDS, HH IS PROPERTY OF THOUSANDS, HH IS NUTEH IS THOUSANDS, HH IS PROPOSED SOURCE(S) 1) FUEL CHIPS-JUNITE FUNIT NUTEH IS THOUSANDS, HH IS	HES FYE		- ~ ~	_	A L S		500	#1r(4	۔			·	HILL
NUTE IS THUISALDS, HE PROPERTY OF THE PROP	4>1	PR00 CUDE	FUEL LUGS LOGS PCHI	FUEL	COST HARVE			H IS	ARVES	F F UE		NIT ASIS	UNIT	
NOTE IS THOUSENDER	~ ~ ~	S1 /	.50.	.00	AST		11. 17.00	S, NO.	ı			26	œ.	
PROPOSED SOURCE CHIPS-4 NOTEH IS THOU NUTEH IS THOU NUTEH IS THOU NUTEH IS THOU NUTEH IS THOU FOR HO NUTEH IS THOU	- Ош					UEL.		SANE OST.					S) IXEC UNIF	Q+'4S
PROPOSED SOUNTELL CHIPPE	0LD if 8 1	AS/	5.50	00.	*	u.	T X ED	10 T		•			SCE ()S-1	HOU
NUTE	NIT UENC ST S	14	u r	UT.			NIC	15 1 1014 FOR					3000 F110 F110	ısı
PROPOS NOTE	SEU SEU	ī												E .
	PUT.	S Y S		ڻ 0				¥ ;					<u>.</u>	75
			ಕ					2	·				£ = 2	2

Figure 2.—Example of harvesting cost analysis per thousand pound of water evaporative capacity.—con.

PROPUSED SUURCES UNIT AT GIVEN AT HIGHER HOISTURE CONTENTS (NET BASIS) PROPUSED SUURCES UNIT AT GIVEN AT HIGHER HOISTURE CONTENTS (NET BASIS) 1) FUEL CHIPS-MIXED FUNIT 22222.2	•		. :	۷-:	•	Ŧ.	X 0
ES UNIT AT GIVEN BASIS M.C. 9-MIXED FUNIT 22222.2 9-JUNIPER FUNIT 22222.2 0 \$ 3.69 COSTS \$ 3.69 L REG \$ 5821.34	1/H H20		ONTENTAL	22222.2 56910.1	3.29	\$2267.4H	\$ 762.6M
ES UNIT AT GIVEN BASIS M.C. 9-MIXED FUNIT 22222.2 9-JUNIPER FUNIT 22222.2 0 \$ 3.69 COSTS \$ 821.34	RAGE CUS	AS18)	ISTURE C	222.2 891.4	3.46 \$	387.18	786.9M
ES UNIT AT GIVEN BASIS M.C. 9-MIXED FUNIT 22222.2 9-JUNIPER FUNIT 22222.2 0 \$ 3.69 COSTS \$ 821.34	ND AVE	(MET 8	16R HO	22 58			•
ES UNIT AT GIVEN BASIS M.C. 9-MIXED FUNIT 22222.2 9-JUNIPER FUNIT 22222.2 0 \$ 3.69 COSTS \$ 821.34	/YEAP) AI	ONTENTS	AT LO.	22222.2 60123.5	3.57	5 2461.6H	\$ 802.5H
ES UNIT AT GIVEN BASIS M.C. S-MIXED FUNIT 22222.2 S-JUNIPER FUNIT 22222.2 O S 3.69 COSTS \$ 3.69	WATER	TURE C			•		
ES UNIT AT GIVEN BASIS M.C. S-MIXED FUNIT 22222.2 S-JUNIPER FUNIT 22222.2 O S 3.69 COSTS \$ 3.69)F EVAPORATED	VARIOUS MOIS	CONTENT * +20 PCT.	22222.2		I	\$ 933.1H
ES UNIT AT GIVEN BASIS M.C. S-MIXED FUNIT 22222.2 S-JUNIPER FUNIT 22222.2 O S 3.69 COSTS \$ 3.69	POUNDS	QUIRED AT		5222.2	4.03 \$	12782.3H	8 873.AM
ES UNIT AT GIVEN BASIS M.C. S-MIXED FUNIT 22222.2 S-JUNIPER FUNIT 22222.2 O S 3.69 COSTS \$ 3.69	THOUSAN	VOLUMES RE	AT HIGHER PCT. +1		3.85 \$		
ES UNIT AT GIV BASIS M.C. 3-JUNIPER FUNIT 22222. 3-JUNIPER FUNIT 22222. 0 S 3.6 COSTS S 3.6 L REG S 8 821.	.000064	ANNUAL	\$	() ()	•	28	•
PROPUSED SUURCES BASIS 1) FUEL CHIPS-MIXED FUNIT 2) FUEL CHIPS-JUNIPER FUNIT NVG. COST/MMH20 SST.D TOTAL COSTS			AT GIVEN	22222.2 61573.6	3.69	\$2549.5M	\$ 821.3M
PROPUSED SUURCES BASINI FUEL CHIPS-JUNIPER FILL CHIPS-JUNIPER FILL CHIPS-JUNIPER FILL COSTS SST.D TOTAL COSTS	JS REGUI		F 12	LINI	•		
PROPUSED SUURCES 1) FUEL CHIPS-JUNI 2) FUEL CHIPS-JUNI NVG. COST/MEM20 :ST.D TOTAL COSTS INPRING CAPITAL REG	SPECTU		10 BA 8	ED FI			
PROPUSED 1) FUEL 2) FUEL NVG. COST SST.D TO	78d ****		SUURCES	CAIPS-MIKE	/meH20	TAL C0315	APITAL PEG
			ROPUSED	1) FUEL 2) FUEL	1VG. COST.	181.0 10	IORK [NG C.

* CALCULAIIUNS ASSUME A KILN EVAPORATIVE RATE OF 1.700 M BTUS PER POUND OF EVAPURATED AATER. EFFECTIVE EVAPORATIVE CAPACITIES FOR WOOD/BARK FUELS ADJUSTED FOR FUEL MOISTURE CONTEUT. THE PROGRAM ALLOWS WOOD FUEL MOISTURE CONTENT TO DROP BELOW ZERO-PCT BUT DISGUALIFIES A FUEL TYPE WHEN MOISTURE CONTENT EXCEEDS 65-PCT.

****** DUE TO A BTU DEFICIT, THIS CALCULATION IS NOT MEANINGFUL.

14205.9 MMBTU'S **** -S PCT. (MET BASIS), THEPE IS AN ANNUAL DEFICIT OF **** WITH MOISTURE CUNTENT CHANGED

Figure 2.—Example of harvesting cost analysis per thousand pounds of water evaporative capacity.—con

Comments First card only, columns 2 through 72. Estimates prepared by CARD TYPE 1: Title card. Project

Second card only. Program constants. CARD TYPE 2: Data entry

Data de- scrip- tion	Number of Harvest Units NHU (12)	Stack Tcm- per- ature STKT (F4.0)	Annual Heating Require- ment AHR (F10.0)	Fixed Cost FCO (F8.0)	Number of Weeks for Working Capital NWC (12)	Risk- profit Require- ment RPR (F5.2)	Card
Cols.	Cols. 2-3	7-10	11-20	23-30	34-35	41-45	
Data entry							
CARD TY	PE 3: Harve	CARD TYPE 3: Harvest unit data. One can	one card per harvest unit.				

Data de- scrip- tion	Enter Har- "U" vest (AC) Unit Num- ber HUNO (12)	Harvest Unit Name HUNME (A6)	Unit's Unit Meas. HYVU (A6)	Harvest Unit's Ac. ACRES (F7.0)	Unit's Vol. per acre VPA (F7.0)	Unit's Fixed Cost HUFC (F7.0)	Number ber of Systems NHS	Cu. Ft. per Harvest Unit HYCF (F6.1)	Card
Cols.	Cols. 1 2-3	5-10	15-20	24-30	34-40	74-50	24-55	29-64	
Data entry	U								

Figure 3 —Fuel harvesting analysis: data coding record.

CARD TYPE 4: Harvest system data. One card per harvest system. Past					SYSTEM 8	& PRODUCT	FHA DATA WORKSHEET DATA FOR HARVEST UNIT:	KSHEET UNIT:						
Enter System's Numer lours System's Fuel to the factor of	CARD 1		Harves	system]] .]	card		E						
TYPE 5: Harvest system's product data. One card per product. (One fuel product only, 10 total) TYPE 5: Harvest system's product data. One card per product. (One fuel product only, 10 total) TYPE 5: Harvest system's product data. One card per product. (One fuel product only, 10 total) First Prod. Wanne Prod. Prod. Vaile Prod. Walle Prod. P	Data de- scrip- tion	ł	L	System's Name HSNME (A6)	Num- ber of Prod- ucts NPR (12)	Hours per Acre HPA (F5.2)	System's Var. Cost HSVC (F7.0)		Fuel Descrip- tion WDBK (A20)	,	Mois- ture Con- tent PHYS(2) (F5.4)	Specific fic Gravity PHYS (3) (F5.4)	Higher C. Heating Value (HMBTU) PHYS(4) (F5.2)	Card
TYPE 5: Harvest system's product data. One card per product. (One fuel product only, 10 total)	Cols.	-	2-3	5-10	14-15	16-20	24-30		31-50		61-65	02-99	71-75	
Fig. Fuel Fuel Fuel Prod- Cu. Ft. Vari- Harket	Data entry	ν												
Enter Fuel Fuel Fuel, Prod- Cu. Ft. Vari- Harket F: Prod. Name Prod. uct's Prod., able Value Prod. Num- FNME Percent- Unit per Cost FMV P: Der (A6) FPP (A6) PRCF (F7.0) uct (12) (F6.2) (F6.2) (F7.0) r F r I 2-3 5-10 15-20 25-30 34-40 44-50 54-60 P P P Prod., Vari- Harket P P (F7.0) P P Prod., able Value P P P Prod., able Value P P P Prod., able Value P P P P Prod., able Value P P P P P Prod. (F7.0) R P P P P P P P P P P P P P P P P P P	CARD 1		1 1	t system'	s produc	1	One card per pro	i i	uel product only,	, 10 total)				
F F 44-50 P P P P P P P P P P P P P P P P P P P P	Data de- scrip- tion	}	ł !	Fuel Name FNME (A6)		Fuel, Prod. Percent- ages FPP (F6.2)	Prod- uct's Unit FPU (A6)	Cu. Ft. Prod., per Unit PRCF (F7.0)	Vari- able Cost FPVC (F7.0)	Market Value FMV (F7.0)	Card			
	Cols.	-	2-3	5-10		15-20	25-30	34-40	74-50	24-60				
	Data entry	(L .						;	:					
d d		Ь												
d d		Ь							-					
d		Ь						:	:					
ď		Ь												
ď		a.	' 									<u> </u> 		
		a												П

Figure 4 —Fuel harvesting analysis: worksheet.

```
FUEL HAPVEST PROGRAM
         č
 ₽.
                     BY GEOPGE HARPULE
 3.
                             AND
         C
                        GIUSEPPE REUSI
                 FOREST PREDUCTS LARGRATORY
         C
 5.
                  P.O. 90x 5130
 6.
         Ċ
                  MADISON, HI 53705
         C
                  COMMERCIAL PHONE: 608/264-5761
 8.
 ٩.
                  FTS PHONE: 364-5761
10.
11.
               DIMENSION PRME(1,10), PRO(1,10), PP(1,10), PUNME(1,10),
                          VUEQ(1,10), PPVC(1,10), MV(1,10) , PUCF(1,10)
12.
13.
               +, PUAV (1,10)
               DIMENSION MCH(9,50), EHVU(9,50), VU(9,50), DPBT(9,50), MMBTU(9,50),
14.
15.
                           TYPE (4,50)
10.
               DIMENSION UR(50), CFPU(50), SG(50), HHV(50), HHX(50), VAA(50), VPU(50),
               +#RKC(9), WCST(9),
17.
18.
                               CHECK(9), TVRT(9), UTIL(9), AVMH(9), PENI(9), TITLE(14)
19.
               DIMENSION
                            MC(9), MC(9), ALPHA(0), BETA(0), GAMMA(9), MTLEV(9), PHYS(9),
20.
                           SPECS(9), *DAK(4), FUEL(4), HYCF(9), PRCF(50)
               DIMENSION HUNO(50), HUNME(50), HYVU(50), ACRES(50), VPA(50), HUFC(50),
21.
22.
                           HVOL(50), IRANK(50), TCF(50)
23.
               DIMENSION HSNO(10), HSNME(10), HPA(10), HSVC(10), FNME(10), FPP(10),
24.
                            FPU(10), VPFU(10), FPVC(10), COST(10), AAF(10), CEU(10),
.55
                           AEN(10), ERFU(10), FMV(10)
26.
               DATA
                       LEVS / 4/
                       WTLIM / 0.65/
27.
               DATA
28.
               DATA
                       EVAT / 1.7 /
Ž٥.
               DATA
                       HUGE /1000000000./
30.
               DATA
                       NINK / 6/
31.
               DATA
                       ( MC(I), I=1,6) / 5,10,20, -5,-10,-20/
32.
               DATA
                       (WTLEV(L), L=1,4) /0.266, 0.444, 0.546, 0.615 /
                       (ALPHA(I), I=1,5) /.935,1.0019,1.0920,1.3128,1.4646/
33.
               DATA
                       ( BETA(I), I=1,5) / .18162,.35454,.51232,.87770,1.09615/
34.
               DATA
               DATA (GAMMA(I), I=1,5) /.00031,.000345,.000385,.00041,.000445/
INTEGER HUND, HSNO, PNO, FPNO
35.
36.
37.
               REAL MCW, MMBTU, MV, QF, MKT, MKV (50), MKTV (50)
30.
39.
         C ***
                              FORMAT STATEMENTS.
            10 FOPMAT (1346,42)
40.
41.
           500 FORMAT (1x.12, 3x,F4.0,
                                              F10.0,2x,F8.0,3x,I2,5x,F5.2)
           510 FORMAT(A1, 12, 1x, An, 4x, Ab, 3(3x, F7.0), 3x, 12, 3x, F6.1)
42.
43.
           520 FURMAT(A1,12,1x,A0,3x,12,F5.2,3x,F7.0,3A6,A2,5x,F5.0,2(F5.4),F5.2)
44.
           530 FORMAT (A1,12,1x,46,4x,F6,2,4x,A6,3(3x,F7,0))
45.
         C ***
                                                     2. OUTPUT
                              FORMAT STATEMENTS.
46.
           600 FORMAT ( // 10x, PROBLEM SPECIFICATIONS // 15x, NUMBER OF HARVEST
              + UNITS',24x,12 / 15x, STACH GAS TEMPERATURE',8x, "IDEGREES F) ",6x,
47.
48.
                       15x, 'ANNUAL HEAT REQUIREMENT', 6x, '(
                                                                 MMRTU)',F10.0/ 15x
49.
              +, OVERHEAD FIXED COSTS', 9x,'( DULLARS)',2x,Fd.0,/,15x,
                                                                               *WORKING
50.
              + CAPITAL REQUIREMENT', 2x, '(
                                                  wEEKS) ', 6x, 13 / 15x,
                                                                           'RISK-PRUFIT
51.
              +PERCENT REG.T',22x,F5.2)
52.
           601 FURMAT ( // 10x, 'PROBLEM SPECIFICATIONS'// 15x, 'NUMBER OF HARVEST
              + UNITS',24x,I2 / 15x,'STACK GAS TEMPERATURE',8x,'(DEGREES F)',6x,
+ F4.0/ 15x,'ANNUAL HEAT PEQUIREMENT',6x.'( MEH20)',F10-0/ 15
53.
54.
                        15x, 'ANNUAL HEAT PEQUIPEMENT', 6x, '(
                                                                   M#H20)',F10.0/ 15x
55.
              +, 'OVERHEAD FIXED COSTS', 9x, '( OULLARS)', 2x, F8.0, /, 15x,
                                                                               'mORKING
Sc.
              + CAPITAL REQUIREMENT', 2x, 'f
                                                  WEEKS) ', 6x, 13 / 15x,
                                                                           'RISK-PROFIT
57.
              +FERCENT REQ.T',22x,F5.2)
           602 FORMAT('n', 9x,'NOTE: IF STACK GAS TEMPERATURE ENTERED IS LESS THA
54.
59.
              +N 100. DEGHEES F., COSTS PER THOUSAND POUNDS OF HER ',/, LOX, 'EVAPO
60.
              +RATIVE CAPACITY WILL BE CALCULATED AS FOR DIRECT-FIRED KILN USE. A
61.
              +NNUAL HEAT HEQUIPEMENTS',/,16x, MUST BE ENTERED AS NUMBER OF THOUS
              +4ND POUNDS OF H20 TO BE REMOVED FROM LUMBER THROUGH #ILN.')
62.
          610 FORMAT('1',//,' MARVEST UNIT ',A6,2x,12,4x,'ACRES',21x,F6.1,3x,'TO +TAL CU. FT. AVAIL',1x,F10.1, 'M',/,' INPUT SEQUENCE NO.',2x,13,4
63.
64.
65.
              +x,'VOL./ACHE IN ',A6,6x,F9.1,3x,'CU. FT., SOLID/UNIT',F11.1,/,' NO
66.
              +. MARVEST SYSTEMS', 1x, 13, 4x, 'MARVEST UNIT FIXED COSTS', F9.0)
```

```
620 FORMAT(///3x'system',4x,'HRS/',2x,'COST/',2x,'PF 3D',3x,'PERCENT',
                +2x,'UNIT',3x,'SOLIN',6x,'UNITS',4x,'PREP',3x,'MKT',3x,'MOIS',4x,'M
+MHTU',6x,'COST/',4x,'M9TU/',3x,'VAR,',/,13x,'ACRE',2x,'HOUH',3x,'C
+ORE',4x,'TOTAL',3x,'NAME',3x,'CU,FT,/',2x,'AVAILAELE',2x,'COST/',2
 66.
 69.
 70.
 71.
                *x,'VAL/', 2X,'CONT', 2X,'AVAILABLE', 4X, 'UNIT', 5X, 'UNIT', 4X, 'COST/',/
                 +,34x,'RECOV',10x,'UNIT',16x,'UNIT',3x,'UNIT',38x,'MMBTU')
 72.
             621 FORMAT (///3x'SYSTEM',4x,'HRS/',2x,'COST/',2x,'PROD',3x,'PERCENT'
 73.
                +2x,'UNIT',3x,'SOLID',6x,'UNITS',4x,'PREP',3x,'MKT',3x,'MOIS',4x,'M
+MRTU',6x,'COST/',4x,'MGTU/',3x,'VAP.',/,13x,'ACRE',2x,'HOUR',3x,'C
 74.
 75.
 76.
                +GDE +, 4x, 'TOTAL +, 3x, 'NAME +, 3x, 'CU.FT. / ', 2x, 'AVAILABLE +, 2x, 'COST/ ', 2
 77.
                +x,'V4L/',2x,'CONT',2x,'AVAILABLE',4x,'UNIT',5x,'UNIT',4x,'COST/',/
 78.
                 +,34x,'RECOV',10x,'UNIT',16x,'UNIT',3x,'UNIT',38x,'M#H2O')
 79.
             630 FORMAT(//,1x,a6,12,2x,F6.2,F7.0,2x,A6,2x,F6.2,1x,46,F7.2,3x,F8.0,F
 80.
                +8.2,1x,F7.2,2x,F3.2,F10.0,3x,F7.2,F11.2,F6.2)
 61.
             640 FORMAT (26x, A6, 2x, F6, 2, 1x, A6, F7, 2, 2x, F9, 0, F8, 2, F8, 2)
             649 FORMAT ('0', 4x, 'NOTE. HARVEST SYSTEM ', A6, 12, ' DISREGARDED. FUEL '
 82.
                + .A6. 'HAS MUISTURE CONTENT ABOVE THE SPECIFIED LIMIT', F6.2)
 A3.
 84.
             650 FORMAT(//15x, *****, 1x, 'LEAST COST HARVEST SYSTEM ', A6, 13, ' ***'/
 85.
                                       ',A6,I3//15x,'-FUEL-',20x,'-ENERGY-'//
                +25x, "HARVEST UNIT
                +12x,'UNITS AVAIL',4x,F8.0,4x,'MMBTU AVAIL',1x,F10.0,/
+12x,'FIXED COST',4x,F9.0,4x,'COST/MMBTU',5x,F9.2/
 86.
 87.
 88.
                +12x, 'TOTAL COST/UNIT', 2x, F8.2)
            660 FORMAT(//1x, 'NOTE---M IS THOUSANDS, MM IS MILLIONS.')
665 FORMAT(' ',4x,'---''''TOTAL COST/UNIT''' INCLUDES HARVEST UNIT FI
 89.
 90.
 .91.
                *XED COST, BUT DOES NOT INCLUDE ****OVERHEAD FIXED COST****, OR COS
                +T (INTEREST)',/,11x, FOR WORKING CAPITAL REQUIREMENT.')
 92.
 93.
             670 FORMAT('1', 1x, 'END OF OUTPUT.')
 94.
 95.
                      FUEL TYPE DATA AND ESTIMATES OF REQUIREMENTS AND COSTS
 96.
              60 FORMAT ('1', //25x,13A6,A2///)
              61 FORMAT
 97.
                            (19x, ******* FUEL TYPE ASSUMPTIONS AND ESTIMATES OF
                                                      ***** HEAT ENERGY
 98.
                +REQUIREMENTS
                                 AND COSTS
 99.
                + SOURCES AND COSTS **** 1/97X, ---- HEAT-ENERGY VALUES---- 1/
100.
                         27x, 'UNIT', 6x, 'UNITS AVAIL.', 4x, 'CU.FT.', 4x, 'SPEC.', 5x,
                 +'M.C.',5x,'S COST',5x,'HIGHER VALUE',4x, 'EFFECTIVE EVAPORATION')
101.
102.
              62 FORMAT
                FIGHAT (5x, ******** FUEL TYPE ASSUMPTIONS AND ESTIMATES OF *REQUIREMENTS AND COSTS (*,F5.0, * DEG.F STACK TEMP.) **************//
103.
104.
                                                                     46x. **** HEAT ENEPGY
105.
                + SOURCES AND COSTS ++++1//97X, ----HEAT-ENERGY VALUES----!/
100.
                         27x, 'UNIT', 6x, 'UNITS AVAIL.', 4x, 'CU.FT.', 4x, 'SPEC.', 5x,
107.
                    "M.C.',5x,' COST',5x, 'HIGHER VALUE',8x, 'HEAT TO STEAM')
              63 FORMAT(27x, 'BASIS', 7x, 'ANNUALLY', 6x, 'SOLID', 5x, 'GRAV.', 4x,
105.
100.
                   '(WET)',4x, 'PER UNIT ',4x, 'MBTU/UNIT ',5x, 'MBTU/UNIT ',4x,
116.
                    'S/MMBTU!)
              64 FORMAT(27x, 'BASIS', 7x, 'ANNUALLY', 6x, 'SOLID', 5x, 'GRAV=', 4x,
111.
112.
                  '(WET)',4x,'PER UNIT ',4x,'MBTU/UNIT ',5x,'#H20/UNIT ',4x,
113.
                   15/M#H201)
              70 FORMAT(3x,12,') ',3A6,A2,A6,4X,F10.0,6X,F6.2,5X,F4.3,3X,F6.4,
114-
115.
                   4x,'$',F7.2,6x,F8.0,5x,F10.2,4x,'$',F8.2)
116.
              80 FORMAT(/1
                                PROPOSED SOURCE(S)')
117-
116.
          C ***
                                      'PROSPECTUS REQUIREMENTS'
119.
            108 FOPMAT(/16X, ***** PROSPECTUS PEGUIREMENTS (*,F11.0,1x, * THOUSAND
120.
                + POUNDS OF EVAPORATED WATER/YEAR) AND AVERAGE COST/M H20 ****'/)
            169 FORMAT(/16x, '**** PROSPECTUS REQUIREMENTS (',F11.0.
121.
122.
                + 1x, "MILLION STEAM-HEAT BTU S/YEAR) AND AVERAGE COST/MMBTU *****/)
123.
            110 FORMAT(43x, -----ANNUAL VOLUMES REQUIRED AT VARIOUS MOISTURE CO
124.
                +NTENTS (WET BASIS) -----//
125.
                +4x, 'PROPOSED SOURCES', 8x, 'UNIT', 7x,
                    'AT GIVEN', 11X, 'AT HIGHER MOISTURE CONTENTAL,
126.
                +14x,'AT LOWER MOISTURE CONTENT**'/27x, 'HASIS', 8x, 'M, C.', 11x,
127.
124.
                   '+5 PCT.',4x,'+10 PCT.',4x,'+20 PCT.',10x,'-5 PCT.',4x,
129.
                  '-10 PCT.',4x,'-20 PCT.'/)
130.
            160 FORMAT
                                                     (4x, 12, ')', 1x, 3A6, 42, A6, 4x, F8.1,
                   8x,F8.1,2(4x,F8.1),9x,F6.1,2(4x,F8.1))
131.
132.
             190 FORMAT( ' **** wITH MUISTURE CONTENT CHANGED ',13,' PCT. (WET BASI
133.
                +S), THERE IS AN ANNUAL DEFICIT OF ',F11.1,13H MMBTU'S ****)
134.
            191 FORMAT( ' ', 4x, '--- CUSTS INCLUDE ''''OVERHEAD CUST''' AND MURKING
135.
                +CAPITAL COST(INTEREST).')
```

```
136.
             219 FORMAT('0',3x,'AVG. COST/M#H20',17x,'$',F9.2,6x,'$',F9.2,2(2x,'$',
137.
                +F9.2),7x,'$',f8.2,2(2x,'$',F9.2))
                                                           ,'s',F7.2,8x,'$',F7.2,2(4X,
138.
             220 FORMAT('0',3x,'AVG. COST/MMRTU',20x
139.
                   '$',F7.2),9x,'$ ',F6.2,2(4x,'$',F7.2))
            230 FORMAT(/4x,'EST.D TOTAL COSTS',16x,'$',F6.1,'M',8x,'$',F6.1,
+ 2('M',4x,'$',F6.1),'M',9x,'$',F6.1,2('M',4x,'$',F6.1),'M'//)
100.
141.
             234 FORMAT (/4x, 'WORKING CAPITAL REQ', 16x, 'S', Fo.1, 'M', 8x, 'S', F6.1,
142.
                   2('M',4x,'5',F6.1),'M',9x,'5',F6.1,2('M',4x,'5',F6.1),'M'//)
143.
             233 FURMAT( + HOOD FUEL CALCULATIONS ASSUME 40-PCT EXCESS 4IR AND 4-P
144.
145.
                +CT HEAT LOSS FROM UNBURNED '/' FUEL, RADIATION AND UNACCOUNTED LOS
                +SES. THE PROGRAM ALLOWS WOOD FUEL MOISTURE'/ CONTENTS TO DROP BE +LOH 0-PCT BUT DISGUALIFIES A FUEL TYPE WHEN MOISTURE CONTENT'/
146.
                +SES.
147.
148.
                +' EXCEEDS 65-PCT.')
149.
             232 FORMAT(' ****** DUE TO A BTU DEFICIT, THIS CALCULATION IS NOT ME
150.
                +ANINGFUL. 1/)
151.
             231 FORMAT( * CALCULATIONS ASSUME A KILN EVAPORATIVE RATE OF
152.
                +F5.3, ' M'
153.
                + BTUS PER POUND 1/1 OF EVAPORATED WATER. EFFECTIVE EVAPORATIVE CAP
154.
                +ACITIES FOR WOOD/BARK FUELS ARE'/' ADJUSTED FOR FUEL MOISTURE CONT
155.
                       THE PROGRAM ALLOWS WOOD FUEL MOISTURE'/ CONTENT TO DROP BEL
                +OW ZERO-PCT BUT DISQUALIFIES A FUEL TYPE WHEN MOISTURE'/' CONTENT
150.
157.
                +EXCEEDS 65-PCT.'/)
            *** FORMAT STATEMENTS. 3. ERROR MESSAGES
555 FORMAT ("0",10%, "ERROR. NUMBER UF HARVEST UNITS IS NOT SPECIFIED
15e.
159.
                +IN THE PROGRAM AND DATA CONTROL CARD. 1)
160.
             560 FORMAT('0',10x, 'ERROR.
161.
                                             INCORPECT CARD TYPE CODE.
                                                                            SHOULD BE HAR!
                + 'VEST UNIT CARD. INPUT SEQUENCE NUMBER ', 12)
102.
            565 FORMAT('0',10%,'ERROR. NUMBER OF HARVEST SYSTEMS NOT SPECIFIED IN + HARVEST UNIT CARD. INPUT SEQUENCE NUMBER ',12)
570 FORMAT('0',10%,'ERROR. INCORRECT CARD TYPE CODE. SHOULD BE HAR',
163.
164.
165.
                + 'VEST SYSTEM CARD. INPUT SEQUENCE NUMBERS', 13, '. ', 11)
100.
167.
            575 FORMAT('0',10x,'EHROR. NUMBER OF PRODUCTS RECOVERED NOT SPECIFIED
                + IN HARVEST SYSTEM CARD. INPUT SEQ. NUMBERS', 13, '. ', 11)
166.
            580 FORMAT('0',10x, 'ERROR.
                                             INCORRECT CARD TYPE CODE.
169.
                                                                            SHOULD BE H.S.
170.
                +FUEL PRUDUCT CAPO. INPUT SEQUENCE NUMBERS', 13, '. ', 11)
            590 FORMAT('0',10x, 'ERROR. FUEL PRODUCT RECOVERY PERCENT INCORRECTLY
171.
            +SPECIFIED. INPUT SEQUENCE NUMBERS', 13,'.', 11 )
595 FORMAT('0', 10x, 'ERROR. INCORRECT CARD TYPE CODE. SHOULD BI
+ , 'FUEL PRODUCT CARD. INPUT SEQ. NUMBERS', 13,'.', 11,'.', 11)
172.
173.
                                                                             SHOULD BE NON-
174.
175.
          C
176.
                 READ
                         (5, 10)
                                     (TITLE(I), I=1,14)
177.
                 wPITE (6,60) (TITLE(I), I=1,14)
176.
          C *** READ IN PROGRAM AND DATA CONTROL CARD.
179.
180.
                 READ (5,500) NHU, STKT, AHR, FCO, NHC, RPR
181.
                 IF
                     (NHU.GE.1) GO TO 501
                 WRITE (6,555)
182.
183.
                 GO TO
184.
            501 CONTINUE
185.
186.
            *** PRINT OUT PROBLEM SPECIFICATIONS
187.
168.
                 IF(STKT.GE.100.0) WRITE(6,600) NHU, STKT, AHR, FCO, NHC, RPR
189.
                 IF(STKT.LT.100.0) WRITE (6,601) NHU, STKT, AHR, FCG, NAC, RPR
                 WRITE (6,602)
190.
191.
                 N=0
192.
            502 CONTINUE
193.
                 N = N +
194.
          C *** READ IN MARVEST UNIT HEADER CARD.
195.
                 READ(5,510) CARD, HUND(N), HUNME(N), HYVU(N), ACRES(N), VPA(N),
196.
                + HUFC(N), NHS, HYCF(N)
197.
                 IF(HYCF(N).LT.0.5) HYCF(N) = 1.0
198.
                 TCF(N) = (ACPES(N) + VPA(N) + HYCF(N))/1000.
                     (CARD.Eq.'U')
199
                 IF
                                       GO TO 504
200.
                 HPITE (6,560)
201.
                 GO
                     TO
202.
            504 CONTINUE
                 IF (MHS.GE.1)
203.
                                   GO
                                       TO
                 WRITE (6,505)
204.
205.
                 GO TO
                          599
```

```
206.
            506 CONTINUE
207.
                15
                    208.
                                         ') HYVU(N) = 'Cu.FT.'
                    (HYVU(N).Eu.
209.
         C *** PRINT OUT HARVEST UNIT CONSTANTS
210.
211.
         C
                WRITE(6,610)MUNME(N), HUNG(N), ACRES(N), TCF(N), N, HYVU(N), VPA(N),
212.
213.
               +HYCF(N),NHS,HUFC(N)
214.
         C *** PRINT OUT MARVEST SYSTEM HEADINGS
215.
216.
217.
                IF(STKT.GE.100.) WRITE(6,620)
                IF (STKT_LT_100.) #RITE(6,621)
HVOL(N) = ACRES(N) + VP4(N)
218.
219.
220.
                M = 0
                MEEST = 0
221.
222.
                BEST = HUGE
                DU 507 I=1.6
223.
            507 SPECS(I) = 0.
224.
225.
            508 CONTINUE
                M = M + 1
226.
         C *** READ IN HARVEST SYSTEM DATA CARD.
227.
                READ(5,520)CARD, HSNG(M), HSNHE(M), NPR, HPA(M), HSVC(M), (HDBK(I), I=1,4
228.
229.
               +),(PHYS(I), [=1,4)
230.
                1 F
                    (CARD.EG.'S')
                                    GO TO 511
231.
                MRITE (6,570) N,
                GO TO 599
232.
            511 CONTINUE
233.
234.
                IF (NPR.GE.1) GO TO 512
                WRITE (6,575) N, M
235.
                GO TO 599
236.
            512 CONTINUE
237.
                    (HSNO(M).E3.0) HSNO(M) = M
238.
         C *** READ IN HARVEST SYSTEM FUEL PRODUCT CARD.
READ (5,530) CARD, FPNO, FNME(M), FPP(M), FPU(M), PRCF(M),
239.
240.
241.
               + FPVC(M), FMV(M)
                IF(PHCF(1).LT.0.5) PRCF(1) = 72.0
IF(PHYS(1).LT.0.5) PHYS(1) = PRCF(1)
242.
243.
244.
                VPFU(M) = PPCF(M)/HYCF(N)
                    (CARD.E9.'F') GO TO 514
245.
246.
                WRITE (6,580) N, M
247.
                GO TO
                         599
            514 CUNTINUE
244.
244.
                IF (FPNO.LE.0)
                                   FPN0 = 1
                MFPP = [FIX(FPP(M))
250.
                IF (MFPP.GT.0) GO. TO 518
251.
252.
                WRITE (6,590) N, M
                GO TO
253.
                         599
254.
            518 CUNTINUE
255.
                PRPCST = FPVC(M)
                QF = (FPP(M)/100.) / VPFU(M)
250.
257.
                JJ = NPR - 1
258.
259.
         C *** TEST FOR MORE PRODUCTS OTHER THAN FUEL
260.
                IF (JJ.E0.0) GO TO 527
261.
262.
                J = 0
263.
            522 CONTINUE
264.
                J = J + 1
         C *** READ IN NON-FUEL PRUDUCT CARD
265.
                READ(5,530) CARD, PNO(1,J), PNME(1,J), PP(1,J), PUNME(1,J),
260.
267.
                              PHCF(1,J), PPVC(1,J), MV(1,J)
26ó.
                VUEG(1,J) = PUCF(1,J)/HYCF(N)
209.
                PUAV(1,J) = ((TCF(N) + PP(1,J)) / PUCF(1,J)) + 10 - 0
270.
                IF (CARD, EQ. 'P') GO TO 524
                JP = J + 1
271.
272.
                #PITE (6,595) N, M, JP
273.
                GO TO
274.
            524 CONTINUE
275.
                IF(PNU(1,J),EQ.0) PNO(1,J)=J+1
276.
                IF (FUNME (1. J).Eq. "
                                         ') PUNME(1,J)= 'CU.FT.'
```

```
277.
                IF(VUEQ(1,J).LE.n.n) VUEQ(1,J)=1.0
278.
279.
         C *** TEST FOR ANDTHER NON-FUEL PRODUCT
280.
261.
                IF.
                    (J.LT.JJ) GO TO 522
282.
               00.526 J = 1,JJ
               WJ = (PP(1,J)/100.) / VUED(1,J)
283.
284.
               QJF = QJ / QF
285.
                PKT = MKT + MV(1,J) + PUAV(1,J)
               PRPCST = PRPCST + (PPVC(1,J) = HV(1,J)) + QJF
286.
287.
           526 CONTINUE
208.
           527 CONTINUE
289.
         C
         C *** COMPUTE HARVEST SYSTEM COST AND BTU'S PER UNIT
290.
291.
292.
                AAF(M) = HVOL(N) + QF
                HRVCST = ACRES(N) + HPA(M) + HSVC(M) / AAF(M)
293.
294.
                COST(M) = MRVCST + PRPCST
295.
                MKTV(M) = MKT
               CALL BUILER( STKT, EVRT, LEVS, WTLEV, WTLIM, PHYS, ALPHA, BETA,
296.
297.
               + GAMMA, MFLAG)
298.
                IF (MFLAG.EG.0)
                                  GO TO 528
                WRITE (6,649) HSNME(M), HSNO(M), FNME(M), WTLIM
299.
300.
               G0 T0
                        533
           528 CONTINUE
301.
                ENGY = PHYS(6)
302.
                CEU(M) = 1000. * COST(M) / ENGY
AEN(M) = (AAF(M) * ENGY) / 1000.
303.
304.
305.
                EEFU(H)=ENGY
               IF (CEU(M).GE.BEST) GU TO 532
BEST = CEU(M)
306.
307.
                MREST = M
308.
309.
           DO 529 I=1,4
529 FUEL(I) = WDBK(I)
310.
                On 531 I = 1,6
311.
            531 SPECS(I) = PHYS(I)
312.
            532 CONTINUE
313.
314.
           533 CONTINUE
315.
         C *** PRINT OUT SYSTEM VALUES FOR FUEL AND MARVEST SYSTEM RESULTS
316.
317.
         C
                WRITE(6,630)H5NME(M),H5NO(M),HPA(M),H5VC(M),FNME(M),FPP(M),FPU(M),
318.
               +PHYS(1), AAF(M), FPVC(M), FMV(M), PHYS(2), AEN(M), COST(M), EEFU(M), CEU(M
319.
320.
321.
         C *** WRITE NON-FUEL PRODUCT VALUE
322.
323.
                IF (NPR .EQ. 1) GO TO 535
324.
325.
                DO 534 J=1,JJ
            534 WRITE(6,640) PNME(1,J), PP(1,J), P(INME(1,J), PUCF(1,J), PUAV(1,J),
326.
327.
               (L,1) VM, (L,1) 3V99+
328.
         C *** TEST FOR ANOTHER HARVEST SYSTEM DATA CARD
329.
330.
331.
            535 IF (M.LT.NHS) GO TO 508
332.
            536 CONTINUE
333.
334.
                00 537
                         1=1,4
            537 TYPE(I,N) = FUEL(I)
335.
                MKV(N) = MKTV(MBEST)
336.
                UP(N) = FPU(MBEST)
337.
338.
                CFPU(N) * SPECS(1)
                MCH(1,N) = SPECS(2)
334.
340.
                SG(N) = SPECS(3)
341.
                HHV(N) = SPECS(4)
342.
                HHX(N) = SPECS(5)
                EHVU(1,N) = SPECS(6)
343.
                VAA(N) = AAF (MBEST)
344.
345.
                VPU(N) = COST(MBEST) + HUFC(N) / AAF(MBEST)
346 -
                MMRTU(1,N) = AEN(MBEST)
```

```
DPBT(1,N) = (VPU(N) / EEFU(MBEST)) = 1000.
347.
346.
         C
               DPBT(1,N) = CEU(MREST) + HUFC(N) / AEN(MBEST)
         C *** PHINT OUT LEAST COST HARVEST SYSTEM
349.
350.
         C
351.
               WRITE(6,650) HSNME(MBEST), HSND(MBEST), HUNME(N), HUNO(N), VAA(N),
                             MMBTU(1,N), HUFC(N), DPBT(1,N), VPU(N)
352.
               WRITE (6,660)
353.
               #PITE (6,665)
354.
355.
               IF (N_LT_NHU) GO TO 502
356.
357.
         C *** DEFINE MOISTURE INCREMENTS FOR SENSITIVITY ANALYSIS
               DU 48 I=1,NINK
358.
359.
                HC(I) = MC(I)
360.
            48 \text{ wC(I)} = \text{wC(I)} / 100.
         C
361.
362.
         C.
         C *** COMPUTE EFFECTIVE HEATING VALUE AND MMBTU+S AVAILABLE ANNUALLY
363.
         C ***
                 PER STANDARD UNIT
364.
               DO 50 N=1,NHU
365.
300.
               PHYS(1) = CFPU(N)
               PHYS(3) = SG(N)
367.
368.
               PHYS(4) = HHV(N)
369.
               DO 51 K=1, NINK
370.
               J = K + 1
371.
               MCW(J,N) = MCW(1,N) + AC(K)
               PHYS(2) = MCK(J,N)
372.
               CALL BOILER( STKT, EVRT, LEVS, WTLEV, WTLIM, PHYS, ALPHA, BETA,
373.
374.
               + GAMMA, MFLAG)
               EHVU(J,N) = PHYS(6)
375.
               IF (MFLAG.EQ.1) GO TO 52
376.
377.
               DPBT(J,N) = (VPU(N)/EHVU(J,N)) + 1000.0
378.
            52 MMBTU(J,N) = (EHVU(J,N)*VAA(N))/1000.0
379.
            51 CONTINUE
380.
            50 CUNTINUE
381.
         C
         C *** RANKING SEQUENCE (TO RANK UPTIONS IN TERMS OF LEAST COST PER
382.
         C *** EFFECTIVE MMHTU'S AT GIVEN MOISTURE CONTENT)
383.
384.
385.
               IF (NHU.LE.1)
                                GO TO 133
               LIMIT = NHU - 1
386.
387.
               DO 120 N=1,NHU
                IRANK(N) = N
368.
389.
           120 CONTINUE
               DO 125 INDEX=1,LIMIT
390.
391.
               IBEST = IRANK(INDEX)
392.
               IPLUS = INDEX + 1
393.
               ISTAR = 0
394.
               DU 130 I=IPLUS, NHU
395.
               II = [RANK(I)
396.
               IF
                  (DP8T(1,II) - DP8T(1,I8EST)) 129, 130, 130
397.
           129 ISTAR = I
               IBEST = II
394.
399.
           130 CONTINUE
               IF (ISTAR.GT.0) IRANK(ISTAR) = IRANK(INDEX)
400.
               IRANK(INDEX) = IBEST
401.
402.
           125 CONTINUE
403.
           133 CONTINUE
404.
405.
         C *** COMPUTE VOLUMES OF RESOURCES REQUIRED
406.
407.
               00 151 J=1,7
408.
               CHECK(J) = AHR
               00 150 K#1, NHU
409.
410.
               N = IRANK(K)
411.
               CHECK(J) = CHECK(J) = MMBTU(J,N)
               IF (CHECK (J) .GT.O.O) VU(J,N) = VAA(N)
412.
               IF(CHECK(J).LT.0.0) VU(J,N) = ((CHECK(J)+MMBTU(J,N))+1000.0) /
415.
                EHVU(J,N)
414.
415.
               IF(MCA(J,N),GT,MTLIM) VU(J,N) = 0.0
               IF(VU(J,N),LT,0.0) VU(J,N) = 0.0
410.
```

```
417.
            150 CONTINUE
418.
            151 CONTINUE
419.
420.
           *** COMPUTE AVERAGE VCOST/MMBTU'S (AVMB) AND TOTAL COST (BENI)
421.
422.
                J = 1
423.
            200 TV8T(J)=FCU
424.
                UTIL(J)=0.
425.
                DO 210 K=1,NHU
                N = IRANK(K)
420.
427.
                TVBT(J) = (VU(J,N)*VPU(N)) + TVBT(J)
                MRKC(J) = ((NMC*VU(J,N))/(52.0*VAA(N))*(TVBT(J)*MKV(N)))*MRKC(J)
428.
429.
                UTIL(J) = ((EHVU(J,N)*VU(J,N))/1000.0) + UTIL(J)
430.
           210 CONTINUE
431.
                wCST(J) = wRKC(J) * RPR
432.
                TVBT(J) = TVBT(J) + mCST(J)
433.
                MPKC(J) = MRKC(J) /1000_0
434.
                BENI(J) = TVBT(J)/1000.0
435.
                AVMB(J) = TVBT(J)/UTIL(J)
436.
                J = J +
437.
                IF(J.LT.8) GO TO 200
438.
439.
           *** FUEL TYPE DATA FOR EACH HARVEST UNIT
440.
441.
                MAITE
                       (6,60)
                               (TITLE(I), I=1,14)
442.
                IF(STKT.LE.100.0) WRITE(6,61)
443.
                IF(STAT.GT.100.0) WRITE(6,62) STAT
444.
                1F(STKT.GT.99.9) WRITE(6,63)
445.
                IF(STKT.LT.100.0) #RITE(6,64)
                #PITE(6,80)
446.
447.
                00 90 K=1,NHU
                N = IRANK(K)
448.
449.
                WRITE(6,70) K, (TYPE(I,N), I=1,4), UB(N), VAA(N), CFPU(N),
450.
                          SG(N), MC+(1,N), VPU(N), HHX(N), EHVU(1,N), DPBT(1,N)
451.
             90 CUNTINUE
452.
                wRITE(6,660)
453.
         C
454.
         C ***
                                    'PROSPECTUS REQUIREMENTS'
455.
450.
                #RITE (6,60)
                               (TITLE(I), I=1,14)
457.
                IF(STKT.LE.100.0) WRITE (6,108) AHR
458.
                IF (STKT.GT.99.9) WRITE (6,109) AHR
459.
                WRITE(6,110)
460.
                DO 171 K=1.NHU
                N = IRANK(K)
461.
462.
                HRITE(6,160) K, (TYPE(I,N), I=1,4), UB(N), (VU(J,N), J=1,7)
463.
            171 CONTINUE
404.
                IF(STKT.LT.100.0) WRITE(6,219) (AVMB(J), J=1,7)
465.
                IF(STKT.GT. 99.9) WRITE (6,220)(AVMB(J), J=1,7)
                JJ = 0
466.
407.
                DO 172 J=1.7
408.
                IF (CHECK(J).LE.0.0) GO TO 172
469.
                JJ = 1
470.
                BENI(J) = HUGE
471.
            172 CONTINUE
472.
                WRITE(6,230) (BENI(J),J=1,7)
473.
                wRITE(6,234) (WRKC(J),J=1,7)
474.
                IF(STKT.LT.100.0) WRITE(6,231), EVRT
                IF(STKT.GT. 99.9) WRITE(6,233)
IF(JJ.EQ.1) WRITE(6,232)
475.
476.
477.
                DO 180 J=1.7
                IF(CHECK(J),GT.0.0) WRITE(6,190) MC(J),CHECK(J)
478.
479.
            180 CUNTINUE
480.
481.
                #RITE (6,660)
                WRITE (6,191)
482.
483.
            599 CUNTINUE
484.
                ₩RITE(6,670)
485.
                STOP
486.
                END
```

The Forest Products
Laboratory (USDA Forest
Service) has served as the
national center for wood
utilization research since
1910. The Laboratory, on the
University of WisconsinMadison campus, has
achieved worldwide
recognition for its
contribution to the knowledge
and better use of wood.

Early research at the Laboratory helped establish U.S. industries that produce pulp and paper, lumber, structural beams, plywood, particleboard and wood furniture, and other wood products. Studies now in progress provide a basis for more effective management and use of our timber resource by answering critical questions on its basic characteristics and on its conversion for use in a variety of consumer applications.

Unanswered questions remain and new ones will arise because of changes in the timber resource and increased use of wood products. As we approach the 21st Century, scientists at the Forest Products Laboratory will continue to meet the challenge posed by these questions.



END

FILMED

11-85

DTIC